Space Weather Technical Forecast

Issued on Wednesday, 02 March 2022 at 00:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1 Minor Geomagnetic Storms later day 3 and day 4. Probable increasing Slight Chance of R1 Minor Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low in the last 24 hours, with no notable X-ray flares recorded at GOES 16. There are currently five numbered sunspot regions on the visible disc. AR2954 and 2955 remain single stable, mature Hsx/Alpha spots in the northwest quadrant. AR2956 (Bxo/Beta) just west of centre disc in the northern hemisphere, continues to weaken. AR28957 in the southeast quadrant has shown growth and consolidation in its lead/trailer portions, now classified Dao/Beta. AR2958 in the northeast quadrant has shown decay in recent imagery, now classified Cao/Beta.

No Earth directed CMEs (coronal mass ejections) have been observed.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, was in the range 470-550km/s. The solar wind density was predominantly at average levels. The Total IMF (Bt) was weak 2-6nT, with the north-south component (Bz) ranging between +5 and -5nT. The phi angle was positive (away from the sun). Geomagnetic activity was Quiet to Unsettled (Kp 1 to 3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES 16 was at Background levels. The high energy electron flux (greater than 2 MeV) has been mostly at Normal Background levels, with a peak of 217 pfu at 01/1725 UTC. The corresponding 24-hour integrated electron fluence was well below the Active (1e8 integrated pfu) threshold with a recent slow rising trend. The 02/0000 UTC observation was 2.55e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low or Very Low, but with a small chance of isolated M-class flares. Chances may increase later in the period as the potential returning regions transit around the eastern limb.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast. Geomagnetic activity is expected to be occasionally Unsettled, with a Slight Chance of isolated Active intervals, declining to mainly Quiet conditions during day 2. Coronal hole 61 is more likely to give G1/Minor Storm periods due to the proximity to the spring equinox and its negative polarity, on days 3 and 4 (04 and 05 March).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels. High energy electron flux is likely to follow an erratic rising trend, with the possibility of exceeding the high (1e3 pfu) threshold during diurnal peaks. Electron fluence is also forecast to follow an erratic rising trend, and may approach the Active

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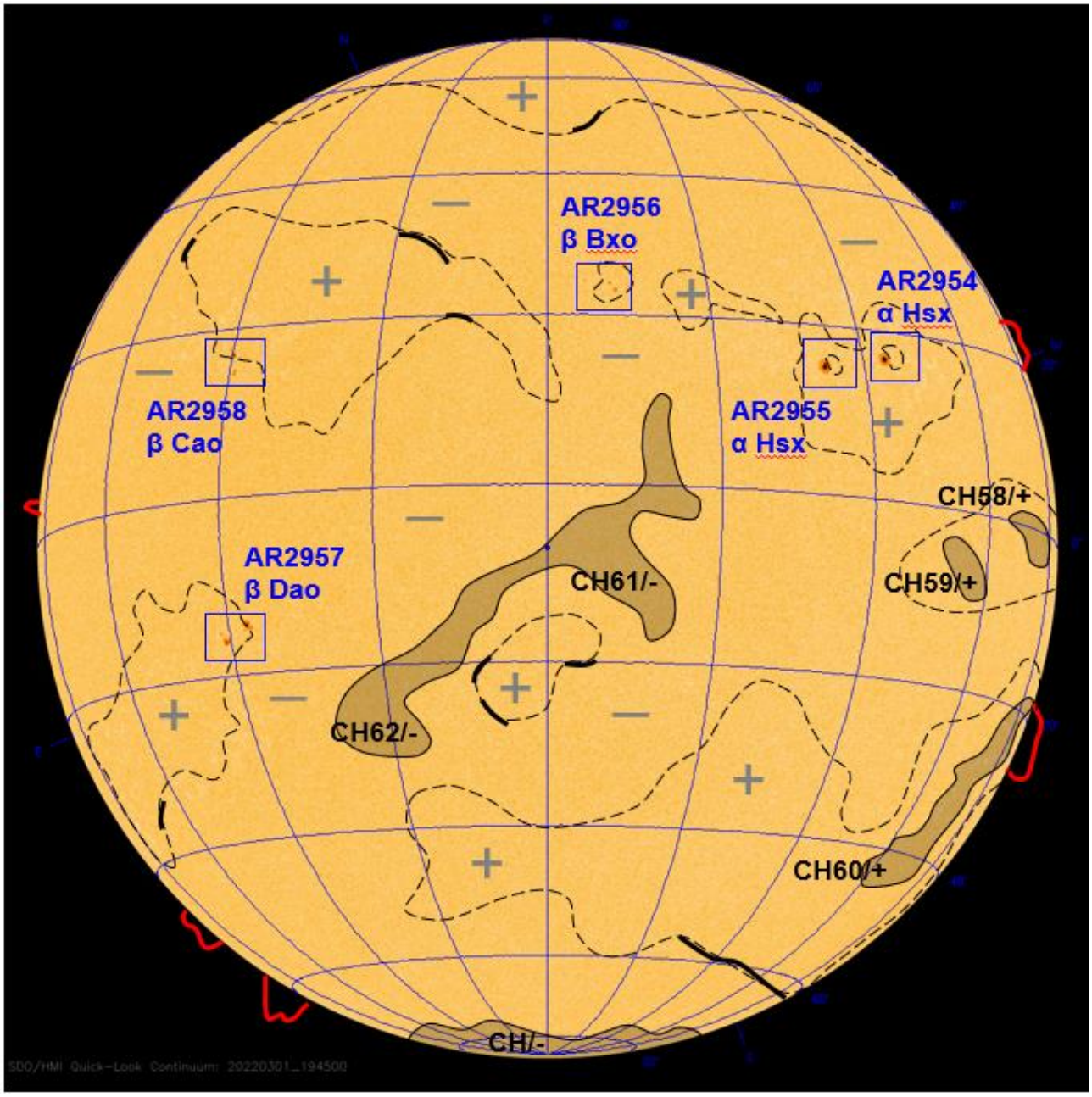
(1e8 integrated pfu) threshold later in the forecast period.

Figure 1. Solar Analysis Valid 01/2000 UTC..



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs that feature in the forecast.
Solar wind speeds are currently at elevated levels following recent connection with the high speed stream from either coronal hole 58 or 60. Further coronal hole influence is likely from CH59 on day 1 (02 March), with elevated wind speeds continuing, before slowly easing into day 2 (03 March). There is then a further coronal hole 61, which is negative polarity, and Earth may connect to the high speed from this later on day 3 (04 March). Coronal hole effects would then be expected to continue through day 4 (05 March).

The coronal hole through day 1 (02 March) is positive polarity, which is less favoured for a significant geomagnetic response at this time of year. As such, geomagnetic activity is expected to be occasionally Unsettled, with a Slight Chance of isolated Active intervals, declining to mainly Quiet conditions during day 2. Coronal hole 61 is more likely to give G1/Minor Storm periods due to the proximity to the spring equinox and its negative polarity, on days 3 and 4 (04 and 05 March).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	40	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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Radio Blackouts - X-Ray Flares:

There are currently five numbered sunspot regions on the visible disc. Those in the western solar hemisphere comprise two single mature, stable, uni-polar sunspot regions, along with a small and weakening bi-polar group. The eastern solar hemisphere contains two bi-polar groups, the larger and more magnetically complex region in the southeast quadrant, with a smaller and weakening, bi-polar group in the northeast.

Two further bright regions evident on STEREO-A imagery are expected to rotate around the east limb during the next few days. Foremost of these appears to be a large region possibly corresponding to Ex-2941 and Ex-2947 in the northern solar hemisphere, as well as an apparently smaller region likely related to Ex-2945 in the south, currently just beyond the southeast limb.

Solar activity is expected to be Low or Very Low, but with a small chance of isolated M-class flares. Chances may increase later in the period as the potential returning regions mentioned above, transit around the eastern limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level throughout.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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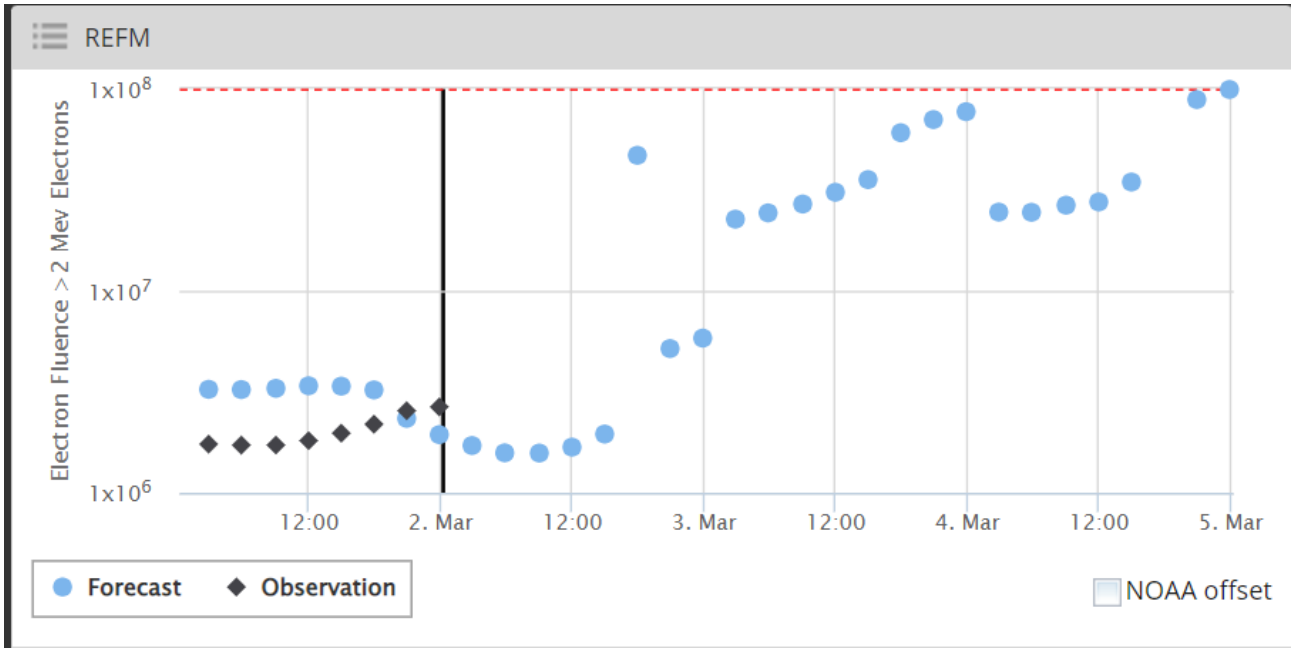
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is currently exhibiting a low trend within Background levels, but should respond upwards in the period given current and forecast high speed streams.

The relevant four-day period from last rotation suffered from CME influences, so REFM guidance and persistence in general is expected to offer less of a steer than would usually be the case, meaning that confidence is lower than usual.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	20	30	50
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 2: MOSWOC REFM



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